

CLAIMS

1. (amended) A polymer electrolyte fuel cell comprising:

a hydrogen ion conductive polymer electrolyte membrane;

an anode and a cathode sandwiching said hydrogen ion conductive polymer electrolyte membrane;

an anode side electroconductive separator having a gas channel for supplying a fuel gas to said anode;

a cathode side electroconductive separator having a gas channel for supplying an oxidant gas to said cathode; characterized in that

said anode and said cathode comprise a gas diffusion layer and a catalyst layer formed on said gas diffusion layer at the side in contact with said hydrogen ion conductive polymer electrolyte membrane,

said catalyst layer has catalyst particles and a hydrogen ion conductive polymer electrolyte, and

at least either of hydrogen ion conductivity and gas permeability of at least either of said anode and said cathode seamlessly varies in a thickness direction of said anode or said cathode.

2. (amended) The polymer electrolyte fuel cell in accordance with claim 1, wherein the amount of said hydrogen ion conductive polymer electrolyte in said

catalyst layer seamlessly varies in a thickness direction of said catalyst layer.

3. The polymer electrolyte fuel cell in accordance with claim 1, wherein the amount of said hydrogen ion conductive polymer electrolyte in said catalyst layer is large at the side of said hydrogen ion conductive polymer electrolyte membrane and is small at the side of said gas diffusion layer.

4. (amended) A polymer electrolyte fuel cell comprising:

a hydrogen ion conductive polymer electrolyte membrane;

an anode and a cathode sandwiching said hydrogen ion conductive polymer electrolyte membrane;

an anode side electroconductive separator having a gas channel for supplying a fuel gas to said anode;

a cathode side electroconductive separator having a gas channel for supplying an oxidant gas to said cathode; characterized in that

said anode and said cathode comprise a gas diffusion layer and a catalyst layer formed on said gas diffusion layer at the side in contact with said hydrogen ion conductive polymer electrolyte membrane,

said catalyst layer comprises a layer comprising catalyst particles; and a layer, which is not in contact with said hydrogen ion conductive polymer electrolyte

membrane, comprising a hydrogen ion conductive polymer electrolyte.

5. The polymer electrolyte fuel cell in accordance with claim 4, wherein said catalyst layer comprises said layer comprising said catalyst particles and said layer comprising said hydrogen ion conductive polymer electrolyte that are alternately laminated.

6. The polymer electrolyte fuel cell in accordance with claim 1, wherein the porosity of said gas diffusion layer is high at the side of said electroconductive separator and is low at the side of said catalyst layer.

7. The polymer electrolyte fuel cell in accordance with claim 1, wherein said gas diffusion layer has a plurality of porous conductive base materials each having different porosities.

8. (amended) A method for producing the polymer electrolyte fuel cell in accordance with claim 1, comprising

a step of, by mixing catalyst particles and a hydrogen ion conductive polymer electrolyte with a dispersion medium, preparing a plurality of catalyst-layer-forming inks having different mixing ratios of said catalyst particles to said hydrogen ion conductive polymer electrolyte, and

a step of forming a catalyst layer in which

hydrogen ion conductivity seamlessly varies in a thickness direction, by spraying said plurality of catalyst-layer-forming inks from different nozzles respectively on one side of a gas diffusion layer or at least one side of a hydrogen ion conductive polymer electrolyte membrane.

9. The method for producing the polymer electrolyte fuel cell in accordance with claim 8, wherein said catalyst-layer-forming inks contain carbon particles that are made water repellent.

10. The method for producing the polymer electrolyte fuel cell in accordance with claim 8, comprising a step of forming said gas diffusion layer, in which gas permeability varies in a thickness direction, by laminating a plurality of porous conductive base materials having different porosities.

11. The method for producing the polymer electrolyte fuel cell in accordance with claim 10, comprising a step of making a surface, which is supposed to be in contact with a catalyst layer, of said gas diffusion layer water repellent.